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POPULATION CHANGE AND THE CANADIAN ECONOMY: A SURVEY OF THE ISSUES

by

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January 1987

This study was conducted in connection with Health and Welfare Canada's Review of Demography and its Implications for Economic and Social Policy (The Demographic Review). For a complete list of Institute discussion papers related to the Demographic Review, see inside back cover.

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91-01537/

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POPULATION CHANGE AND THE CANADIAN ECONOMY: A SURVEY OF THE ISSUES

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1. Introduction

This paper is intended as a contribution to the Review of Demography and Its Implications for Economic and Social Policy. Our purpose is to provide an overview of the demographic changes that have taken place in recent decades in Canada, the changes that are in prospect for the next several decades, and the manner in which the Canadian economy is likely to be affected by these changes. As the title of the Review recognizes (and as is, of course, obvious), changes in the size and composition of the population have social as well as economic implications. The boundary between "social" and "economic" is not always well defined, and too much emphasis on the distinction can be a hindrance to the proper understanding of matters as broadly based as those with which the Review is concerned. Nevertheless, we are writing as economists and our concern is principally the economic implications of population change. If we touch on some social issues, that is merely incidental.

It is hardly necessary to make the point that the population and the economy are closely connected. On the supply side of the economy, the most obvious linkage is with the labour force: the rate of growth and age structure of the population influence the rate of growth and age structure of the labour force, and they influence also its per capita productivity, by virtue of their effects on average levels of training, general education, and working experience. Changes in the labour force imply changes in the nation's capacity to produce goods and services. Simultaneously, the demand for those goods and services is influenced by the same set of underlying demographic factors: the rate of growth and the composition of demand are affected by the rate of growth and age structure of the population. This is true of the demand for output produced in the private sector, the demand for services provided by governments at all levels, and the demand for imports. It is true also of the demand for capital investment goods as well as consumer goods, and for social capital (schools, hospitals) as well as private physical capital (factories, office buildings, machinery and equipment). The economic-demographic linkages are very strong. Major changes in the population cannot help but have a major impact on the economy. Canadians have witnessed the changes brought about by the "baby boom" of the 1940s and 1950s, and we are now witnessing (and seeking to anticipate) the consequences of the "baby bust" of the past quarter century.

* This paper draws heavily on on-going research that has been supported by the Social Sciences and Humanities Research Council of Canada. The computer programming and related statistical work underlying the projections used in the paper were carried out by Christine Feaver.

We shall be concerned in the paper with economic-demographic linkages, what these linkages imply for the future (given the present population of Canada and the course along which it is moving), and the issues that seem to us important from the point of view of public policy. We should make it clear that we are not concerned here with policy *prescription*; that is outside of our frame of reference. Our interest is rather in identifying issues, indicating what we think to be their importance, and thereby (we hope) providing some guidance for the design of the Review's research program in the next two years.

The plan of the paper is as follows. We begin, in the next section, with a brief review of Canada's population history. We consider next the historical relationship between the labour force and the population. Some basic demographic projections to the year 2036, and an associated projection of the labour force, are presented. We then return to the subject of how the population and the economy interact with each other, giving detailed attention to issues on both the supply and the demand sides of the economy. A separate section is provided on the role of immigration in the determination of economic-demographic change (an important consideration in view of the significance of immigration as an instrument of public policy). A section on the demographics of subpopulations then follows, this being an important and neglected area of study, we think. A section on the "demographics" of the stock of physical capital is provided. (A strange topic for inclusion, one might think, but we shall try to make the case that the age structure and efficiency of the stock of plant, equipment, and other types of capital are closely linked to changes in population, and therefore proper subject of concern in the present context.)

The economic effects of population are thought of usually at the level of the macro-economy. However, the effects at the level of individuals are worth noting also, and we provide a section on that subject. (Whether a person is born into a large birth cohort or a small one may have a significant effect on his or her life course.) Issues relating to changes in life expectancy and the characteristics of the future elderly are accorded a separate section. We then return to a subject that is quite clearly a "macro" subject: the relationship between economic and demographic growth, and just what is meant by "economic growth".

The penultimate section of the paper is entitled, "Is There a 'Population Crisis'?" Its aims are to size up the demographic situation, as we see it, and to put it into some historical perspective. The concluding section sets forth a list of topics or research areas that we think deserve consideration in drawing up the Review's future research program.

2. The Demographic Setting

We begin with a brief review of recent Canadian demographic history. The main elements in the history of population growth in this century include (1) the massive immigration that took place in the period before World War I, (2) the subsequent lower levels of immigration and the continued long-run decline of the birth rate until the late 1930s, (3) the rise of the birth rate thereafter and the very sharp upward movement of

fertility levels in the late 1940s, (4) the "baby boom," sustained through to the end of the 1950s, and coupled with large-scale postwar immigration, (5) the "baby bust" of the 1960s and 1970s, and the continuing low levels of fertility that have persisted through the 1980s. The persistent long-run general decline in mortality rates and the concomitant rise in life expectancies are also features of note.

Levels and rates of growth of the population are presented in Table 1, by five-year intervals, for the period 1951-1986, together with information about the broad age distribution of the population and some related calculations of "dependency ratios". The population has increased continuously over this period, but the rate of increase has been declining since the mid-1950s. In the period 1951-1956, the population grew by almost 15 per cent; by 1981-1986 the rate was just slightly more than 5 per cent. In three decades the growth rate has been reduced by almost two-thirds. Changing levels of immigration have contributed to changes in the growth rate. Falling mortality rates have also had some effect by reducing the rate of loss through death. However, the most important determinant by far has been the birth rate, and more fundamentally the rates of fertility that underlie the birth rate.

The total fertility rate was about 2.6 live births per woman in 1937, a record low point in Canadian demographic history up to that time. It had risen by 1949 to 3.5, and by 1959 to a level in excess of 3.9. The implication of the latter figure is that if the 1959 patterns of fertility had been maintained by Canadian women throughout their childbearing years, each woman would have had, on average, about four children. In the event, these patterns were not maintained. The total fertility rates started to decline after 1959: by 1969, the rate was down to 2.4; by 1979 it was under 1.8; and by 1984 (the latest year for which an estimate is available), it was just under 1.7. For the population to just replace itself each year in the long run, a total fertility rate of about 2.1 is required. Canadian fertility is thus now well below the replacement level, and has been well below that level since the early 1970s. That does not mean, of course, that the population has ceased to grow: the rate of growth is related also to the age structure of the population, and the legacy of the baby boom is that the population still has a relatively large proportion of women in their childbearing years. Annual net immigration – immigrants less emigrants – continues to be substantial and positive, and mortality rates continue to fall, so that there is some offset to the sustained low fertility levels. However, the rates of fertility are the dominant factor and their continuation in the future would virtually assure an upward drift of the average age of the population and a sharply declining growth rate.

The changes in age distribution are indicated in Table 1, in broad terms, by the percentages in three groups: under 20, 20-64, and 65 and over. The effects of the "baby boom" are obvious: some 40 per cent of the population were under 20 in 1956, or two out of every five Canadians. Even though fertility rates had started to fall, they were still high enough to drive the proportion up to about 42 per cent by the mid 1960s, before the inevitable decline commenced. By 1976 the under-20 age group had fallen to less than 36 per cent, and by 1986 it had dropped to just under 29 per cent.

As the proportion of young people has fallen, the proportion of elderly has risen. The latter proportion was more or less constant in the range 7.6 to 7.8 per cent through

the 1950s and the first half of the 1960s. By 1971 it had risen to 8.1 per cent, and it moved up sharply thereafter; a whole percentage point was added in each of the five-year periods 1976-1981 and 1981-1986. The population 65 and over represents today about 10.7 per cent of the total population, compared to about 7.7 per cent 20 years ago. The demographic phenomenon that has come to be referred to as "population aging" is now firmly established.

Changes in the age distribution have obvious implications for the relative numbers of dependents in the population. Age boundaries are at best crude indicators of dependency: some young people leave school and enter the world of work sooner than others; a substantial proportion of adult women are outside the labour force at any given time, keeping house and caring for children; some people retire earlier than others. Nevertheless, the broad age groups of Table 1 do give some rough indication of how the proportions of "economically active" and "economically inactive" in the population have changed in relation to each other. To draw out implications of this kind we have included three types of "dependency ratios" in the table. The first is calculated by expressing the total population as a ratio to the population aged 20-64, the latter being taken to represent the "economically active" component. The other two ratios are the ratios of population under 20 and population 65 and over to the 20-64 population: they may be interpreted roughly as a "young dependency ratio" and an "old dependency ratio." More refined measures of dependency are possible but these simple ones are nevertheless revealing.

It is evident from the table that while the proportion of elderly people has increased in the past two decades, the overall dependency measure has decreased, and quite substantially. The declines in the proportion of children in the population have more than offset the increases in the elderly proportion: from a high point of 1.99 in 1966, the ratio of total to 20-64 population has fallen to 1.65 in 1986. This simple but striking result is extremely important to an understanding of the economic effects of "population aging". It suggests something that is borne out by other findings, namely that the main problem for the economy has not to do with an "insufficiency of resources" (read "too low a level of gross national product") to provide for the increasing numbers of elderly people, but rather with the redirection of resources from uses associated with youth (e.g., schools) to uses associated with old age (e.g., nursing homes, chronic care hospitals). The proportion of elderly people has increased, but the proportion of people in the age range 20-64 has also increased. Popular references to the "aging population" phenomenon sometimes imply that the basic problem is a greatly increased dependency burden. Based on other work, as well as the simple calculations reported in Table 1, it is our view that the problem is much more that of redirecting resources than of the overall availability of resources.

3. The Labour Force in Relation to the Population

The sizes and growth rates of the Canadian labour force and population are juxtaposed in Table 2, again by five-year intervals from 1951 to 1986. Also shown in the

table is an overall "dependency measure" calculated by expressing the total population as a ratio to the total labour force.

The time pattern of labour force growth rates is roughly similar to that of the population lagged by two decades. Changes in participation also affect labour force growth, as do changes in rates of immigration and proportions of older workers retiring. But in broad terms the falling fertility levels of the 1960s are mirrored in the lower rate of labour force growth in the 1980s: the population growth rate fell from 13.4 per cent in 1956-1961 to 9.7 per cent in 1961-1966; correspondingly, the labour force growth rate fell from 16.6 per cent in 1976-1981 to 7.6 per cent in 1981-1986.

The "dependency ratios" in Table 2, calculated as the ratios of total population to total labour force, are larger than those in Table 1, calculated as ratios of total population to population aged 20-64. However, both series tell essentially the same story. The ratios were high in the 1950s and 1960s, and have fallen substantially in the 1970s and 1980s. Rising female participation rates have caused the population/labour force ratios to fall more sharply than the ones based strictly on population. The result is that the 1986 population/labour force ratio of 1.98 is some 27 per cent lower than the peak of 2.73 in Table 2, which occurred in 1961.

4. The Demographic Outlook

Projections of the population are presented in Tables 3-7, based on alternative assumptions about future fertility, mortality, and immigration rates. The format of the tables is the same as that of Table 1: projected population sizes, growth rates, age distributions, and "dependency ratios" are shown, at five-year intervals. The five projections are labelled A to E. The principal assumptions on which they are based are as follows:

> *Projection A ("Medium Assumption")*: The total fertility rate remains at 1.7 throughout the projection period, with age-specific fertility rates assumed to remain in fixed proportions to the total rate. Immigration into Canada is set at 100,000 and emigration at 50,000 per annum, resulting in net immigration of 50,000; the age distributions of immigrants and emigrants at the time of migration are assumed to be similar to recent historical distributions. Mortality rates continue to decline (for most age-sex groups) until the year 2031, but at a decelerating pace; the initial rates of mortality change are based on annual average changes calculated from 1961 and 1981 life tables, and the time paths between these and the zero rates of change in 2031 are obtained by linear interpolation.
>
> *Projection B ("Low Fertility")*: The same as Projection A except that the total fertility rate declines (linearly) from 1.7 in 1986 to 1.4 in 1996, remaining constant thereafter.

Projection C ("High Fertility"): The same as Projection A except that the total fertility rate rises (linearly) from 1.7 in 1986 to 3.0 in 1996, remaining constant thereafter.

Projection D ("High Immigration"): The same as Projection A except that annual immigration is 150,000 throughout the projection period (implying net immigration of 100,000).

Projection E ("Low Mortality"): The same as Projection A except that changes in mortality rates are assumed to continue until 2081, rather than 2031 (i.e., the changes still take place at a decelerating rate but the point at which they cease altogether is 50 years later).

The purpose in displaying five sets of projections rather than only one is to provide information about the sensitivity of the projections to the choice of assumptions. The computation of population projections is straightforward once the assumptions are decided upon; it is the assumptions themselves that are critical. Generally speaking, the further into the future one projects, the less reliable the results, and projections for several decades should therefore be regarded with great caution. Projections made in the late 1930s and the 1940s failed to anticipate the sudden upsurge of fertility rates and the resulting "baby boom", and therefore were found within just a few years to have grossly underestimated the rate of population growth. Projections made in the 1950s were conditioned by the very high birth rates of that period and failed to anticipate the "baby bust", with consequent overshooting. Those who make demographic projections are now much more cautious, choosing often to present a substantial range of projections rather than just one or a few. In spite of much effort to understand the processes that underlie the determination of fertility and mortality, the uncertainties about these processes are still so great that claims about the reliability of predictions should be viewed with much skepticism. Future fertility rates are both critical to the evolution of the population and particularly difficult to predict. Migration is also difficult to predict, depending as it does on government policy and conditions external to Canada. In short, population projections are to be studied for their implications but not to be believed!

Having said all of that, it is nevertheless the case that some aspects of population change can be predicted with much greater confidence than others. Short of large-scale migration, changes in the population of working age can be predicted for two decades or so into the future with considerable confidence because they depend on births that have already taken place and numbers of people already in the population. The population that will reach the age of 65 in the next several decades can also be predicted with some confidence. The total number of people over the age of 65 is somewhat harder to deal with because it depends on future mortality rates as well as on the population today of ages 55, 45, 35, etc., but it too can be predicted with some accuracy, at least in respect of major changes in size. There are then some elements in our demographic future that we can be relatively sure of and some that we cannot.

Let us turn now to Projection A, as reported in Table 3. The most critical assumption here is that fertility rates will remain at their current levels. As can be seen, the demographic trends that have been evident in the 1970s and 1980s will persist,

according to this projection, in the coming decades. The overall rate of growth is seen to decline steadily, although it remains positive until the latter part of the 2020s. The proportion of population under the age of 20 falls in every five-year period and the proportion 65 and over rises. An estimated 10.7 per cent of the total population are 65 or over in 1986; the proportion is projected to rise to 13.4 per cent by 2001, and to 25.1 by 2036. If present fertility rates are maintained (and given the other assumptions of Projection A), half a century from now one out of every four Canadians will therefore be of age 65 or greater.

One might think that such a large increase in the proportion of elderly people would impose a heavy "dependency burden" on the Canadian population and the Canadian economy, and indeed this is often assumed to be the case. However, a comparison of the projected "dependency ratios" in Table 3 with the historical ones in Table 1 puts the situation in a different light. The "old dependency ratio" continues to rise but the "young dependency ratio" continues to fall well into the early years of the next century. Overall, the ratio of total population to population 20-64 remains quite stable, in the range 1.62 to 1.65, until the latter part of the second decade of the century. It then rises, reaching 1.83 by the year 2036. But 1.83 is still well below the 1966 level of 1.99, and indeed below the levels experienced throughout the 1950s and 1960s. As we have said before, population-based ratios are merely rough indicators of "dependency". (Among other things, the per capita "dependency cost" may be higher for the elderly than for children.) However, they do suggest that in spite of the much larger numbers and proportions of older people in the population anticipated for the next half-century, the resources required will at least not be much greater (and may well be substantially less) in relation to the economy's capacity than has been experienced throughout much of the period since World War II (even abstracting from future productivity gains, which would increase further the economic base for the support of dependent members of the population). The *allocation* of resources will be quite different, and the problems of adjustment and of adapting public expenditure programs will be substantial, but the *levels* of resource requirements should not be inordinately high in relation to the ability of the economy to meet those requirements.

The foregoing is obviously painted with a broad brush. Research on the changes in resource requirements to be anticipated as a result of population change is certainly desirable. However, at this early stage we are concerned more with establishing resource allocation as a major issue and with defusing the "scare" view that the Canadian economy will be unable to cope with the "massive burden" of supporting the elderly population of the future. There are many important problems to be addressed but in our view a prospective "insufficiency" of national resources or productive capacity is not one of them.

Let us turn to the alternative population projections. Reducing fertility rates (Projection B, Table 4) produces a more rapid decline in growth rates, higher future proportions of elderly and lower proportions of children, and some net reduction of overall "dependency ratios". Increasing fertility rates (Projection C, Table 5) has a marked opposite effect: the assumed large increase in the total fertility rate (3.0, compared to 1.7 in Projection A) prevents the rate of growth from declining and induces a lower proportion of elderly and a higher proportion under the age of 20. The ratios of total population to population 20-64 are higher; by 2026 the ratio is 2.01 and by 2031 it is at its peak of 2.07.

The overall "dependency ratio" thus exceeds the 1966 level of 1.99 by the latter part of the projection period, but only by a little. In the circumstances of the 1980s it is very difficult to believe that a rise in fertility levels of the kind postulated for Projection C, sustained into the fourth decade of the next century, is a likely possibility. The assumption underlying this projection is an extreme one introduced for the purpose of drawing attention to the importance of fertility in determining the demographic future.

Increasing immigration from 100,000 to 150,000 per annum (Projection D, Table 6) has comparatively small effects. The rate of population growth rises in the late 1980s but then falls again, through to the end of the projection period, although the rates in each period are higher than in Projection A. Effects on the age distribution are relatively small and the dependency ratios are accordingly little affected. In general, alternative levels of immigration are unlikely to have much effect on the broad features of demographic change in the next half-century.

Alternative patterns of mortality are also not of major importance in this regard. Doubling the period of future mortality reductions (Projection E, Table 7) does raise the proportion of elderly population, but just a little. Even by the year 2036 the proportion aged 65 and over is increased only from 25.1 per cent to 26.2 per cent. At 1.86, the ratio of total to 20-64 population is only slightly higher in the year 2036 than the corresponding 1.83 ratio of Projection A. It is natural to think of "people living longer" as a key element in determining the future size of the elderly population. To be sure, increased life expectancy does have some effect, especially at the upper end of the old age range. But in broad terms again, mortality is likely to be much less important than fertility as a determinant of future demographic change. The present age structure of the Canadian population is primarily a reflection of historical changes in fertility levels, and this will continue to be the case in future decades.

5. The Future Labour Force

A single projection of the labour force is provided in Table 8. The underlying population assumptions are those of Projection A. Labour force participation rates are assumed to follow the trends of recent decades; in particular, female rates are assumed to continue to rise and the rates for older males to decline. We view this labour force projection as a "medium" projection, and give to it the same label (Projection A) as its population counterpart.

The pattern of decline in the projected labour force growth rates is quite striking. The five-year rates of growth fall steadily during the balance of this century and the first two decades of the next one. Indeed, by the period 2011-2016 the growth rates have turned negative, and they stay negative throughout the remainder of the projection period. Greater increases in participation rates than those projected could alter the time path of the growth rates. So could higher levels of immigration. However, it is likely that both effects would be relatively minor. Only a sharp increase in fertility levels would be likely to have a major impact on the future pattern of labour force growth. Such an impact could not occur before the latter part of the decade 2001-2011, at the very earliest,

because of the time lag between births and labour force entry. A rise in fertility might be accompanied by lower labour force participation rates of women, so that in fact there might be a negative effect on the labour force in the intervening two decades. But all of this is purely hypothetical. There is no evidence to suggest that a sharp increase in fertility levels is imminent, or indeed likely to happen at all in the foreseeable future. We simply wish to make the point that the earliest that any effect of this kind could occur would be some two decades from now. In all likelihood, the general pattern of decline in the labour force growth rate is well established for several decades to come.

The projected population/labour force "dependency ratios" show some decline from 1986 to 2001. Commencing in the latter half of the second decade of the next century they move up significantly, reaching a level of 2.16 in the year 2036. But 2.16 is still far below the 2.73 level attained in 1961 (see Table 2), and in fact well below the levels experienced throughout the 1950s, 1960s, and earlier 1970s. The population/labour force "dependency ratios" thus support the conclusion yielded by the population-based ratios of Table 3: by historical standards, the future aggregate "dependency burden" is not likely to be particularly onerous, the process of population aging notwithstanding.

6. How the Population and the Economy Interact

We turn now from the discussion of actual and projected changes in the Canadian population and labour force to a consideration of what these changes may imply for the economy. More generally, we consider the ways in which the population and the economy interact with each other. The discussion here is necessarily rather general and abstract. A detailed determination of the interactions within the Canadian economic-demographic system would be most helpful in appraising the likely effects of population change on the economy of Canada in coming decades. We and others have done work on the development and application of computer-based economic-demographic models but a more comprehensive and detailed model than now exists for Canada would be desirable. We note the development of such a model as a possibility for incorporation into the Review's research program. In any event, our present aim is to provide a general statement of economic-demographic linkages.

The discussion is facilitated by reference to Figure 1. Basic components of the joint economic-demographic system are represented by rectangles; channels of influence are represented by arrows. The diagram is intended mainly to be suggestive. A much more complete diagrammatic representation is possible but the simplified one presented in Figure 1 is sufficient for present purposes. Only major channels of influence are represented in the diagram.

Rates of fertility, mortality, and migration (immigration, emigration) are represented by the rectangle at the upper left corner of Figure 1. These rates operate on the population through time to determine its size and rate of growth; simultaneously, they determine its age distribution. At any given time the existing age distribution also influences the rate of growth: a population with a large young-adult component will have a larger proportion of women of childbearing age, and hence a higher crude birth rate, for

any given set of fertility rates; it will also tend to have higher levels of emigration by virtue of the fact that younger adults typically have higher migration rates than older ones. Similarly, a population with a larger proportion of old people will have a higher crude death rate for any given set of age-sex-specific mortality rates. The internal demographic dynamics are thus represented by the three rectangles at the left of the diagram and the arrows connecting them.

The most obvious and direct effect of population change on the economy is through its effect on the labour force. The births of today become the young labour force entrants some two decades hence. The connection between current births and future labour force entrants is affected by the fact that school-leaving ages vary, but in broad terms the impact is quite predictable. The births-labour-force connection represents a basic lagged response in the economic-demographic system, viewed as an integrated dynamic process.

The effect of immigration on the labour force is, of course, immediate. The age distribution of immigration is such that it has a large working-age component. The same is true of emigration. Migratory flows in both directions thus contribute directly and without time lag, the net effect being the resultant of the age-sex-specific flows in the two directions. A policy of encouraging the immigration of working-age adults would, of course, enhance the immediate impact on the labour force. But young adult immigrants bring with them children, or bear children subsequently, and these children grow up and enter the labour force in future years. They also bear their own generation of children who become labour force entrants in another two decades, and so on. A point of general importance is the distinction between the *flow* effects of immigration and the *stock* effects. "Manpower policy" (to use what is rapidly becoming an outdated term) has typically focussed on the flow effects on the labour force, but there are very important long-term stock effects as well.

The population size and age distribution combine with prevailing rates of labour force participation to determine the size and age-sex distribution of the labour force at any given time, and hence the available input of labour services into the nation's productive activities. (Two points: (1) Hours of work and the conventional part-time/full-time distinction also influence the available level of labour input services but we ignore them in this "broad-brush" description. (2) We are implicitly describing the economic-demographic system in the conventional national accounting framework, and thus avoiding what are, in fact, very important issues relating to the treatment of housework, the care of children, and activities within the home generally, which are not valued in the conventional calculation of national income.) Other broad categories of productive inputs are the services of the physical stock of capital (buildings, machinery and equipment, etc.) and the services or information flows represented by the existing state of technology.

The set of available productive inputs determines the nation's productive capacity or capabilities, as indicated by the arrows leading into the rectangle labelled "National Productive Capacity". The extent to which the capacity is actually used, and the resulting level of national income, are influenced also by what are termed in the diagram "Utilization Rates". These rates represent rates of employment (or unemployment) of the labour force and rates of utilization (or underutilization) of the stock of physical capital. We show a single arrow from "Utilization Rates" to "Capacity Utilization and National

Income", and no arrows into the "Utilization Rates" rectangle. Unemployment and capacity underutilization would conventionally be viewed as endogenously determined within the economic system, at least in part, but there are competing views on the manner of determination. Consideration of demographic changes implies essentially a concern with longer-run relationships and the longer-run influences on unemployment rates are especially uncertain. We therefore make no attempt to depict feed-back effects from the other elements of the economy to the "Utilization Rates" rectangle. A relationship between population age distribution and overall unemployment rates can also be noted: in particular, young people typically have higher rates than others, and one would expect a large youth component in the labour force to raise somewhat the overall average rate. However, we have ignored this type of effect also in the diagram.

The national income provides the base for private consumption expenditures, public revenue (principally through taxation), and national saving, as indicated by the arrows. Public revenue in turn provides the base for the provision of publicly provided services (schools, hospitals, police services, etc.). But the provision of public services and patterns of private consumption and national saving are influenced also by the population – by both its rate of growth and its distribution by age. (A large child component implies a heavy demand for school facilities; a large elderly component implies a heavy demand for nursing homes and medical services; rapid growth of the young adult population implies increased household formation and savings in the form of residential ownership; and so on.) The linkages of the population with the levels and patterns of demand for goods and services can be seen as the demand counterpart to the supply linkages represented by the population-labour-force connection. There is a tendency to consider the labour force or supply-side effects of population change in isolation from the demand-side effects. However, a proper understanding of the effects of population change on the economy requires that both be taken account of together. A comprehensive and detailed model of the integrated economic-demographic system would be a most helpful tool in this regard.

The level of national saving determines the rate of capital investment, as indicated at the right side of Figure 1. The rate of investment, operating in conjunction with rates of depreciation, then determines the growth of the stock of physical capital. The capital stock, in turn, provides the input of capital services noted previously. A basic loop within the economy is thus completed – from productive capacity to national income to investment to capital stock, and back again to productive capacity.

All of the foregoing relates to economic-demographic linkages in one broad direction – from the population to the economy. Linkages in the other direction, and feed-back connections from the economy to the population, are much more uncertain, and much more a matter of debate. We show an arrow-connection from the "Capacity Utilization and National Income" rectangle to the "Fertility, Mortality, and Migration Rates" rectangle in order to record the existence of linkages from the economy back to the population, but the nature of these linkages is much less certain than the ones in the other direction. There have been considerable theorizing and various attempts at empirical determination of macro-economic influences on fertility; Richard Easterlin in some well known studies in the 1960s and 1970s proposed and developed an intergenerational theory that implies long cycles in fertility rates, for example. But the

matter is highly conjectural. The effects on mortality rates are also not clear; one assumes some general impact of economic conditions on health status and the availability of health-care services, but such relationships are easier to make explicit in the context of a developing country than in the context of a developed industrial nation such as Canada. There are undoubtedly connections between the state of the economy and government immigration policy, but the stability and predictability of these is uncertain too. In short, we have a long way to go before we can speak with any confidence about how economic factors influence demographic factors. This reason alone imparts uncertainty to long-term population predictions.

7. Issues on the Supply Side of the Economy

We return in this section to some of the issues noted in the previous one relating to the effects of population change on the supply side of the economy, and also introduce some others. The lagged relationship between the birth rate and the numbers of young labour force entrants has been noted. The average age of entry is perhaps somewhere around 18 but for a given cohort entries into the "permanent" work force are spread over a wide range, from about 16 to, say, 30 or more (as in the case of highly specialized physicians). (In addition, there is labour provided by students in the summers and on a part-time basis during academic years.) Casual impressions suggest also that there is a good deal more coming and going than used to be the case – more students dropping out of the formal education system and then returning. The idea of well defined educational termination dates for individuals seems no longer to be quite as appropriate as it once was. In any event, the distribution of labour force entry ages has the effect of loosening somewhat the connection between the period of birth of a cohort and the period of labour force impact. The connection remains strong, nevertheless.

Young labour force entrants not only add to the sheer size of the labour force; in large measure they represent also the vehicle for bringing in new skills and enhancing the average levels of education and training. New knowledge and skills are imparted to the young and from this point of view their subsequent contribution to the stock of "human capital" may be greater than their numbers alone would indicate. (Skill in the use of microcomputers is a conspicuous example of contemporary importance.) On the other hand, young workers are inexperienced. The productivity of younger members of the labour force is thus influenced positively by the recency of their education and training, but negatively by their lack of on-the-job experience. How these two influences offset each other is not well known or easy to document.

Young workers have an additional characteristic that is of importance from the point of view of the productive efficiency of the labour force. They are more mobile than older workers – both geographically and occupationally, and also in terms of movements among employers. They are less tied down by personal responsibilities, experience specific to particular jobs or companies, and the habits and caution that come with age. A labour force that is growing rapidly because of large influxes of youthful workers is likely to be more adaptable than one that is characterized by slow growth and an older average age. This is of general importance in the present and prospective Canadian demographic

situation. It is also of specific importance in relation to the flexibility of particular industries and occupations, for the speed with which they can expand or contract without major disruption will depend in some degree on the mobility of workers, and this will be in part a function of age distribution. We return to this idea in a later section.

We have been discussing young workers from the point of view of their impact on the labour force on the assumption that they are employed. Unemployment rates among young people have always been relatively high, for reasons associated with "frictional" unemployment and the general mobility characteristic just noted. But these rates have been particularly high during the 1970s and 1980s, a fact that has been widely recognized and has given rise to various youth-oriented employment programs and policies. An important issue has to do with the rate at which large numbers of young workers can be absorbed into the labour force within a short period of time. At least, that has been an important issue in the past decade or two. The aging of the "baby boom" generation and the falling-off of the labour force growth rate robs it of some of its importance today, although high youth unemployment rates, as such, remain a matter of concern. The extent to which the size of the "baby boom" labour force entrance cohorts did actually contribute to high youth unemployment rates has never really been clear. Some people have simply asserted the importance of cohort size but hard evidence is generally lacking. Indeed, the issues of "what causes youth unemployment" and "what should be done about it" are a good deal more complicated than is often supposed, we think. Youth unemployment can be properly understood only in a broad labour market context, and more generally in the context of the overall macro-economy. Matters such as the degree of substitutability between younger and older labour need attention in this regard. Cohort size may have been a significant contributing factor but the extent of its contribution is, we think, uncertain. In any event, large labour force entrance cohorts are a thing of the past; the "baby boom" generation is now in its middle or late twenties and thirties.

Prolonged unemployment of young people results in national production foregone, of course, as does unemployment of any group within the labour force. But it may also represent an attrition of newly acquired skills, as a result of an inability to apply them. The acquisition of working experience is delayed, with consequent effects on average productivity levels.

We have noted the direct and immediate impact of immigration on the labour force, and we return to the subject of immigration in a later section. Immigration is often viewed as a policy instrument for dealing with particular skill imbalances, insofar as it can, in fact, be controlled by the Canadian Government, and insofar as prospective immigrants to Canada with the desired skills are, in fact, available. But as an instrument of policy it can be used essentially in only one direction: immigrants can be allowed in when there are skill shortages but by and large emigrants cannot be forced out when surpluses arise. (Some control over migrant workers is possible, but unlikely to be of much importance in Canada.) A large proportion of the immigrants who enter the labour force this year will still be in the labour force in the year 2020 and beyond. Immigration has often been regarded as a short-term policy instrument but its effects last far beyond the short term.

Mortality is of little direct practical consequence for the labour force: the rates are relatively low over the labour force age range and further reductions over this range are likely to have only a very minor impact. The issue of retirement age is a more significant one. Labour force participation rates for men over 55, and more especially over 65, have been on a long-run downward path. The issue of enforced retirement at a fixed age is now before the courts in a series of cases, but in any event there is no evident tendency for the downward movement of older-age participation rates to cease; the tendency towards earlier retirement seems to be firmly entrenched at the present time. However, the general matter of retirement age and its implications for labour force growth is of some importance. A line of argument that one hears frequently is that older workers should be encouraged to retire earlier in order to make way for younger ones, thus reducing youth unemployment and bringing in "new blood" (or perhaps better, new brain cells). Insofar as early retirement is enforceable, it represents an instrument of adjustment for employers seeking to reduce their work forces. The broad issue of retirement and its relationship to labour force adjustment and age distribution is worth attention in the future research program encompassed by the Review, we believe.

Changes in labour force participation rates in general are important. The rates for women continue to rise, and further increases seem most likely. In addition, the attachments of women to the labour force have become increasingly firm – many more can be expected to work throughout most of their lives, perhaps dropping out for brief periods to bear children and care for them as infants, or as pre-schoolers. The relationship between fertility rates and female labour force participation rates at different ages is clearly of interest; in broad terms, there is no doubt an inverse relationship but research that would enhance our understanding of the details of the relationship would seem desirable, and might aid in making more accurate predictions of future participation rates and labour force growth. Further in this connection, the role of formal and informal child-care arrangements is a matter of importance. Note too the implications of the conventional way in which the gross national product is measured: unpaid work in the home is excluded, but if the same work is done for pay, by persons outside the home, it is included. The mother who sends her child to a day-care centre so that she can take a job not only has her own work valued for inclusion in the GNP, but the services provided by the centre are also valued. Had she stayed home and cared for her child herself, on the other hand, there would have been no work recorded in the national accounts. This anomaly is well known in the national accounting context but its practical importance has increased considerably. It is a matter that should be given greater attention than it has in assessing the effects of increased female labour force participation, we believe.

8. Issues on the Demand Side of the Economy

Demographic effects on the demand side of the economy are clearly widespread. Effects on household consumption patterns are easy to illustrate by example (higher birth rates increase the demand for children's toys), but not so easy to detect empirically. Age-distribution effects have been surprisingly resistant to detection in econometric demand studies, including those that have used time series, those that have used cross-section data from household expenditure surveys, and those that have used international (cross-

country) data. Effects on aggregate consumption-saving patterns are hard to detect, and so too are effects on broad categories within the aggregates. It seems likely that one of the reasons for lack of clarity in consumption-category effects is the breadth of the categories for which statistical data are available; it may well be – and some studies have suggested this – that one has to work with quite narrowly defined categories in order to get close to age-distributional effects. (The effects of population size and growth are generally clear; it is the age-distributional effects that are not.)

Public expenditure patterns can be markedly affected by changes in age distribution, and this is true of expenditures at all levels of government. Education expenditures are obviously related to the numbers of children in the population, first at the elementary level, then the secondary level, and finally the post-secondary level. Urban neighbourhoods across the country reflect the legacy of the "baby boom" and the consequences of the subsequent "baby bust", in the form of excess school capacity, the closing of some schools, the conversion of others to noneducational uses, and the tearing down of still others. This is not to suggest that expenditures on education and numbers of students should vary directly with each other (abstracting from price inflation). There are obviously other factors besides enrolment that determine expenditure levels, including built-in rigidities or time lags in response, changes in the "quality" and "technology" of education, and geographic factors (school buildings are immovable; the student population may be increasing in some areas at the same time as it is decreasing in others, requiring new school construction even though excess capacity exists elsewhere). Enrolment rates can also vary, especially at the post-secondary level. But the general effects of lower fertility levels, and consequent lower crude birth rates, are (to nobody's surprise!) to reduce the demand for student places and to exert downward pressure on education expenditures. At the other end of the age spectrum, increases in the numbers of elderly people imply a greater demand for health care and increased transfer payments in the form of old age security and publicly funded pension payments. (In respect of health care, per capita expenditures on physician, hospital, and related services rise very sharply with age for people in their fifties, sixties, and above.)

Education, health care, and old age security and pensions are the major categories of government expenditures that are most sensitive to demographic change. But other categories are affected also. The requirements for places in correctional institutions, crime-prevention services, recreational facilities, and so on also have some sensitivity to the population age distribution. We have done some work on the estimation of demographic effects on various categories of government expenditure, as well as the net effects on total government expenditure. However, further investigation of this aspect of the economic impact of population change would seem desirable.

One might consider also the linkages between the demand and supply sides of the economy in the form of effects of educational and health-care expenditures on labour productivity. Insofar as expenditures on health care reduce days of absence from work, or increase efficiency on the job, there is one such linkage. In general, this is likely to be relatively unimportant in quantitative terms, we think, but nevertheless it is a consideration in light of the much reduced inflows of young people into the working population, and the consequent smaller supply of labour from that source. Effects of programs to encourage healthier life styles (e.g., to reduce smoking) might have some

significant labour productivity effects; so too might programs to reduce industrial accidents. However, it seems far more convincing to justify such programs on the basis of their impact on the well-being of individuals than by some calculation of numbers of person-years added to the annual supply of labour.

Expenditures on education as an offset to reduced numbers of young labour force entrants are likely to be a more important consideration. Education, in this context, should be broadly defined to include training and skill development generally, as well as education in the more conventional sense. A great deal of effort has been expended to determine the effects of education on productivity. (The question was considered particularly important in the 1960s and earlier 1970s.) It is not at all clear, we think, that the nature of the linkage is well understood, in spite of the work that has been done. The forecasting of the demand for particular skills and occupations has also been considered important for purposes of "manpower planning" (our apologies for again using this term!), and in particular for the planning of training programs. Again it is not clear that such forecasting has been all that successful. In any event, we note the whole issue of education and skill training as a relevant one in the context of the Review – relevant because of its implications for the augmentation of the *effective* supply of labour (through increased per capita productivity) in future decades, when the labour force is destined to grow much more slowly as a result of the population age distribution.

The effects of population change on the demand for investment goods is in part direct and in part indirect. The indirect part derives from the effects on the demand for consumer goods and services, which may imply reduced demands for the products of some industries and increased demand for the products of others. Indirect effects result also from induced demands for investment goods needed to produce other investment goods. (The transmission of such effects throughout the economy is usually studied in an input-output framework – a framework in which the flows of products into, out of, and between individual industries are specifically identified.) Direct (or more or less direct) effects result from the demand for new housing associated with family or household formation, the rates of such formation being obviously related to the numbers of young adults in the population.

Effects on the demand for schools, nursing homes, chronic care hospital beds, and the like are also more or less direct. In any event, it is clear that the investment sector of the economy is affected by demographic changes, as are the other sectors. There are also effects on investment as a result of changes in population growth rates, aside from changes in the age distribution, as such: other things equal, a slowly growing population will generate a lower level of demand for investment goods than a rapidly growing one. The effects of slower population growth on the rate of capital accumulation was an important issue in economic debate in the 1930s and 1940s; it is again an important issue in the 1980s.

9. More on Migration

Migration merits some further attention. Instruments relating to migration are really the only population control instruments available to governments in Canada. In theory, transfer payments (subsidies) could be used to encourage childbearing, if that were a goal of policy. However, that is simply not a realistic possibility in the Canadian setting. Expenditures on health care (broadly defined, to include such things as programs to discourage smoking and alcohol consumption, as well as hospital and medical services) and expenditures on medical research have a bearing on mortality rates, but they are surely not undertaken to influence mortality as a population control device. That leaves only devices to influence migration, internal or external.

At the national level the Canadian government obviously can (and does) exercise direct control over both the numbers and the characteristics of immigrants. (Worker skills may be considered particularly important in the framing of immigration policy.) The degree of control is, of course, limited: political considerations and compassionate motives play a role, and the availability of potential immigrants abroad with characteristics considered desirable is not controllable. Economic circumstances in other countries, as well as those in Canada, presumably enter into the decisions of persons considering immigration. Moreover, emigration is not directly controllable; in some cases a government may be able to influence the decisions of potential emigrants (the provision or termination of jobs for aeronautical engineers, for example, by the use of subsidies or direct employment measures). But in the main, control of immigration remains the principal, if not the only direct policy measure for population control at the national level.

The same is true at the provincial, regional, and local levels. Provincial or municipal governments may be able to stimulate inflows of population from other provinces, or to influence the geographic distribution of population within a province. Incentive-disincentive options may be available; subsidies or special tax advantages for locating in particular areas are possibilities. Regional development policies may be implemented by federal or provincial governments, based on tax-subsidy incentives or direct employment initiatives. In short, measures to influence the geographic distribution of population are possible, whereas (practically speaking) measures designed to affect the course of population development by influencing fertility and mortality are not. Governments can try to anticipate the effects of fertility and mortality changes, and to adjust to them accordingly, but they have virtually no possibilities of altering the fertility and mortality levels themselves for purposes of population control.

We have emphasized the long-run or *stock* effects of immigration as an important consideration. Immigration control as a "manpower policy" device is usually viewed in a short-run (flow) context, but it has major long-run implications, both for the supply of labour and for the economy (and the society) at large. Short-run immigration policy thus implies long-run policy as well, even though the latter may not be clearly recognized.

There is a basic philosophical issue involved in setting immigration policy. Suppose we ask the apparently simple question, "What level of immigration would be best for Canada over the next two decades?" Clearly we have in mind the Canadian population when we ask this question; we are concerned with the well-being ("welfare," in the

economics jargon) of the people who live within the national boundaries. But the population of Canada *changes* as immigrants enter: the immigrants themselves become part of that population, the well-being of which we are concerned with. In a short-run setting we may regard the change in population as negligible and the issue as of no practical importance. However, in a long-run setting – and the study of demographic effects must certainly be concerned with periods measured in decades, rather than just in months or years – the issue is of some importance. Whose "welfare" should we seek to maximize in setting immigration levels: that of the present Canadian population or that of the Canadian population as it will become? As a theoretical or philosophical matter, the issue is well recognized in the economics-of-migration literature.

It is sometimes suggested that returns to scale should be considered in immigration policy – that countries with large populations have economies of scale available to them that small countries do not have, and that the effects of immigration on population size should be taken into account from this point of view. A counter-argument that has been put is that the increase in population would have to be so large as to require massive infusions of immigrants if non-negligible economies of scale were to be achieved. The issue is something to be considered but in comparison with other effects of immigration, the economies-of-scale effects may well be relatively very small.

It is more often argued that immigration should be used to offset "labour shortages" in the economy. Sometimes people have in mind shortages of particular skills, in which case immigrants' skills can substitute for the training of domestic workers, which may require considerable time. Skill shortages may represent "bottlenecks" that restrain the economy and result in unemployment of other resources complementary to the one in short supply, it is argued. Selective immigration may be able to break those bottlenecks. Sometimes, though, it is argued that immigration should be used to alleviate *general* shortages of labour, and here the argument may be much less firmly based. Indeed, the concept of a "general labour shortage" is itself not well defined. If immigrants are intended to reduce a "general labour shortage" one needs to look at their likely effects on the economy as a whole – on the demand side of the economy, as well as on the supply of labour – and to define very carefully just what is meant by the notion of a "general labour shortage".

10. The Demographics of Subpopulations

Subpopulations of the overall population have their own demographic structures and dynamics. The populations of individual provinces or regions are often studied and projected. However, there are other subpopulations of interest that have received little or no explicit attention. We have in mind especially the populations of workers in particular industries and occupations.

The age structure of the working population, or labour force, in a given industry or occupation is important for two reasons. First, it bears on the mobility and adaptability of the workers, and on the recency of their training. A work force that is relatively young may be more adaptive and creative, and more familiar with newer techniques of

production. Young workers are better able to find new jobs when their industry or occupation falls on hard times and employment is reduced. Second, though, distribution by number of years to retirement also bears on the speed with which employment in a given industry or occupation can be reduced without serious hardship. An older work force may be less adaptive and mobile but it will also have a higher rate of retirement; the work force may therefore be able to contract more rapidly as a result of natural attrition.

The whole issue of industrial and occupational age distributions and dynamics seems to us important from the point of view of policy relating to employment adjustment. At a time when major changes in restrictions affecting Canadian-U.S. trade flows are under consideration, the implications of age distributions in industries that may be adversely affected are of obvious importance.

We have started recently to examine the age distributions of some particular industries and occupations and hope to be able to continue this line of study. The age distribution of agriculture, for example, exhibits much more of a rectangular pattern than the pyramidal pattern typically associated with the general population, reflecting the rapid emigration of young people from the farm sector in recent decades. The population of teachers is also of special interest: this population grew rapidly during the heavy student enrolment years resulting from the "baby boom", whereas the demand for teachers has fallen off sharply as a result of the "baby bust". What is the present age distribution of teachers? How fast will the teacher population adjust to current demand levels through retirement and exits to other occupations? How quickly have the teacher-training institutions responded to surpluses in the teacher market? What does the age distribution of teachers imply for the general creativity and adaptability of the profession? To what extent has a large population of teachers implied political or institutional pressure which has caused the demand for teachers to exceed what it otherwise would have been? (In other words, how much of the demand has been supply-induced?) These are interesting questions, it seems to us. They are relevant at all levels of education – elementary, secondary, and post-secondary. A particular concern often expressed at the post-secondary level has to do with how the aging of the profession affects the creativity of university faculties.

Such questions can be asked of other professional populations. The population of physicians is another good example. There is a considerable literature on supply-induced demand for physicians' services, and a widely held view that such inducement is quantitatively important. In a period when the constraining of health-care costs is a hot policy issue, the age distribution and associated rates of physician entry and exit are highly relevant concerns. In general, professional populations have their own internal demographics, and if they provide services to the population at large they interact with that population in interesting and important ways. The aging of the general population implies increased demand for some types of health-care specialists and reduced demand for others: how fast can the health-care professions respond?

11. The Stock of Capital from a Population Perspective

We have noted the implications of population change for human age distributions, creativity and adaptability, and rates of retirement. There are parallel implications for the stock of physical capital: the stock of machines, equipment, and structures has its own age distribution, as does the stock of "human capital", and the two age distributions are related.

Schools provide a good example. During the years of heavy student enrolment there was continuing pressure to build new schools or expand existing ones. During the subsequent years of low birth rates and much lighter enrolment, the pressure has been to contract, convert, or tear down school buildings. Relatively little new investment in schools takes place and the existing stock of facilities grows older.

The same is true rather more generally throughout the economy. Population increase is one of the two main driving forces behind long-term economic expansion. (Technological change is the other.) To the extent that slower population growth goes with slower growth of the economy, the volume of new investment is reduced and the average age of the physical capital stock rises. Technological change can render the stock obsolete more quickly than would otherwise be the case, and can provide a stimulus to new investment. But other things equal, the stock of physical capital is likely to exhibit dynamic processes similar to those of the human population. Investment is the "birth process", depreciation and obsolescence the "death process", and the two processes acting together produce changes in the age distribution of the stock, as well as in its rate of growth.

Slower human population growth need not produce uniform aging throughout the stock of capital. To the extent that larger proportions of elderly people imply greater needs for hospital facilities, nursing homes, retirement homes, and the like, new investment in these will produce a young component of the stock – and the newly created facilities will represent the current state of the associated technology, rather than the state of technology as it was in earlier decades. In any event, we think that in some respects the age dynamics of the physical capital stock are likely to be closely related to the dynamics of the human population. This relationship represents a significant economic-demographic linkage and is therefore worth considering in any overall appraisal of the effects of population change on the economy.

12. Population Change and the Individual

The size of the cohort into which one is born can have a considerable bearing on one's life course. The children of the "baby boom" have experienced the effects of large cohort sizes, the children of the "baby bust" just the opposite. Large flows of "baby boomers" into the labour market may have contributed to the high rates of youth unemployment. Using a model of a kind developed by Nathan Keyfitz, we have done some preliminary work on the estimation of relationships between population age distribution and rate of job promotion in the Canadian labour force. More refined estimates can be

made, and the work extended, but the results obtained to date suggest that changes in the age distribution can have a substantial effect. The basic idea underlying the models is that the larger the proportion of the labour force at ages older than that of an individual, the slower will be that individual's rate of advancement within an employment hierarchy. On this basis, our estimates suggest that prospective changes in the age distribution of the Canadian labour force may affect the timing of promotions for younger male cohorts by as much as several years, on average. The issue is one that deserves further attention (along with that of how age distribution affects the mobility, adaptability, and rate of attrition of the labour force).

Other issues related to the effects of cohort size on individual life courses are of interest also. The possible effects on unemployment rates we have noted previously. The effects on fertility rates are another: Richard Easterlin's well known theory has fertility rates moving inversely with cohort size, implying long cycles in the birth rate and in the unemployment rates and income levels of successive generations of young adults. By virtue of its size, the "baby boom" generation attracted an immense amount of attention from governments, educators, the advertising media, and so on, as it moved through the schools and into the young adult population. It continues to attract great attention as it now moves on through into middle age. By the second decade of the next century it will be moving into the "senior citizen" phase of its life course. How will the individuals in this generation compare in working experience, retirement pattern, income security in old age, and so on, with individuals in previous generations? How will they compare with individuals in the "baby bust" generation, which is following on behind?

13. Life Expectancy and the Elderly of the Future

Table 9 shows life expectancies at ages 0, 1, 65, and 80, for decennial census years from 1931 to 1981. Over the whole of that 50-year period, the expected lifetime of a newborn child increased by some 12 years for males and 17 years for females. The life expectancy for males at age 65 rose from 13.0 in 1931 to 14.6 in 1981, a comparatively modest gain. The expectancy for females, on the other hand, rose from 13.7 to 18.9, an increase of more than half a decade. Female life expectancies exceeded male expectancies throughout the period but the greater gains for women have widened the gap considerably. At age 0, a female could have been expected to live some 7 years longer than a male in 1981; at age 65, she could have been expected to live more than 4 years longer. A continuation of recent trends would increase the differences still further. An important and well known consequence of the greater female life expectancies is the large proportion of widows among women of advanced age.

We use terms such as "old age" and the "elderly population". But what is a reasonable definition? Ages 60 or 65 are conventional, but that is their only justification. One issue then is where to draw the boundary: At some arbitrary fixed age? At that age that cuts off a fixed proportion of the average life span? At the age that cuts off a fixed number of remaining years? The question has no single answer, of course. We note it simply to draw attention to the arbitrary nature of any given definition.

A distinction that is often made (albeit an arbitrary one itself) is between the "young old" and the "old old". This distinction is a very important one. The needs, health status, lifestyle, and so on of people in their late sixties is typically much different from what they are for people who have survived to their late eighties. The income security of the two groups may be quite different too, especially if private pensions are largely or entirely defined in nominal dollars rather than constant dollars, and have been eroded by inflation over the 20-year period. (The adequacy of pensions, and the concept of financial security in old age are, of course, important issues, in general, in an assessment of the effects of population aging; so too are the costs of publicly funded old age security and pension payments.)

Another set of issues has to do with the age of retirement. At what ages do people retire now and at what ages will they retire in the future? What should public and private-employer policy be with regard to compulsory retirement? Should retirement be sudden and total, or phased in through a period of part-time employment for workers at the ends of their careers? Should early retirement be encouraged in order to facilitate employment reductions, and to allow more job opportunities for young people? Labour force participation rates have been falling more or less steadily for males over 55, and especially for those over 65. Will this trend continue? (That seems likely.) The situation for older women is less clear from the statistical time-series evidence: on the one hand, older women are influenced by the general trend towards earlier retirement; on the other, they are influenced by the general trend towards higher female participation rates over the life course. How will these two influences operate in the future, and what will be the net effect on the participation rates of older women?

Health status is a critical consideration in assessing the circumstances of the elderly – much more critical than calendar age. Another important consideration is level of education and prior lifestyle. We have recently completed a study (with Peter Pineo, the McMaster sociologist) of the effects of education on the propensity of older people to take courses of one kind or another. It is clear that there is a rather strong positive relationship. More generally, it is clear that how the elderly will (or will wish to) spend their years of retirement in the future is likely to be different, on average, from how previous generations of elderly have spent theirs. In part this is related to higher income levels, but in significant part also it is related to education, and differences in interests that are strongly associated with education. The elderly of future decades will be better educated than those of the past and realistic planning should take this into account.

Whatever the improvements in health-care knowledge and techniques, the average requirements for health care will continue to rise sharply with advancing age. Clearly the aging of the population will therefore exert upward pressure on national health-care costs. There is, then, a whole set of important issues relating to the most appropriate types of facilities and institutional arrangements for caring for the elderly, when they are sick or infirm. To what extent can nursing homes substitute for chronic care hospital beds? To what extent can retirement homes or care provided to persons living in their own homes substitute for nursing homes? What will be the dependency status of the future elderly: the parents of the "baby boom" generation have more children to provide family support (on average) in their old age than will the parents of the "baby bust" generation; how will this affect the need for publicly provided support? In general, what

levels of public support will be needed, and what opportunities will there be for substituting lower-cost facilities, arrangements, and health-care treatment for higher-cost ones, without reducing the effective levels of care?

14. Population Growth and Economic Growth

We return now to the macro-level and consider the issue of growth – growth of the population, growth of the economy, and the relationship between the two. It is sometimes suggested that population growth is desirable in its own right, and that the decline of the population growth rate is therefore, of itself, unfortunate. It is hard to take the population-growth-for-its-own-sake argument very seriously. A more serious question may be how slower population growth affects the rate of economic growth.

The "rate of growth of the economy" is not unambiguously defined. One can define it simply as the rate of growth of the real (i.e., price-adjusted) gross national product. Alternatively, one can define it as the rate of growth of GNP per capita, of personal income per capita, of consumption per capita, of consumption per adult equivalent member of the population, and in a variety of other ways. Other things equal, if the rate of population growth declines then, in the long run, the total GNP can be expected also to increase less rapidly. More important considerations are what happens to per capita income or product measures and how fast the economy can adjust to conditions of slower growth. The issue of the effect of slower population growth on the economy was an important one in the depressed 1930s, and in the earlier 1940s in planning for postwar economic reconstruction, with continued slow population growth anticipated. The postwar population growth rendered the issue irrelevant in North America. However, in the demographic conditions of the 1980s and the prospective conditions of the 1990s and beyond, it does not seem unreasonable to consider the issue again. Rates of saving and capital accumulation are linked to growth and the investment goods industries prosper or fail, depending on the rate of capital accumulation. Will slower population growth reduce sharply the future demand for capital goods? (For example, will reduced rates of household formation have a depressing effect on the demand for residential capital, and hence on the residential construction industry?) Will there be changes in technology that will make it profitable to replace existing plant and equipment with new types before they would otherwise have been replaced? What will be the normal demand for replacement of the capital stock, given its present age structure, and will the time path of replacement demand offset the effects of slower population growth or augment them?

As a general proposition, it has long been recognized that a rapidly growing economy is better able to effect adjustments to its structure. Resources can be transferred more easily among industries and regions, price-income relationships can be adjusted with less tension, and so on, if there is rapid growth. When growth declines, the adjustments become more difficult. When job opportunities are not expanding in other industries, workers fight harder to keep the ones they have. Moreover, as the labour force ages, its natural degree of mobility is lessened, thus aggravating the adjustment difficulties. Industries that have prospered by serving the investment requirements of an expanding economy now find the demand for their products sharply reduced and they

fight for survival. A further point to note in this regard is that the demographic outlook for Canada is very much like that for the United States: to the extent that slower population growth affects domestic demand for investment goods, it is likely also to affect export demand.

The general issues, then, are how population growth is related to economic growth and how slower growth and an aging population structure will affect the ability of the economy to adjust to changing circumstances.

15. Is There a "Population Crisis"?

A naive view that is sometimes given expression is that the future population will contain so large a proportion of old people as to place an immense burden on society. In fact, when account is taken of the smaller proportion of children and the overall proportion of people in the labour force, this view is simply not sustainable. There is certainly no "crisis" in prospect, in the sense of an inadequacy of resources. The problems to be confronted have to do with the allocation of those resources, and the adjustments needed to move from the present allocation to one consistent with the age-related requirements of the future. That is certainly not to suggest that such problems are unimportant and lacking in challenge, but rather to distinguish them from the non-problem of inadequate national resources. Of particular concern in the public policy context are pensions, housing, and health care for the elderly. The greater the increases in labour and capital productivity in the future, the easier it will be to make the necessary adjustments.

The economy has had several demographic "shocks" in this century—the massive immigration of the pre-World War I period was one. The "baby boom" and "baby bust" were others. The effects of the "boom" and the "bust" continue, and will continue for many decades. (Indeed, demographic shocks produce "echo" effects which can last for hundreds of years, although the effects become weaker and weaker.)

There is an important difference between the demographic future as we can see it today and the future as it would have appeared in the mid-1940s. The "baby boom" was not foreseeable (except with the wisdom of hindsight, perhaps!). The numbers of people entering old age in the next few decades are, on the other hand, quite foreseeable, at least as to their general orders of magnitude. The future elderly are, for the most part, already in the population. The 65-year-olds of 2006 are this year's 45-year-olds, less some deaths and immigration, plus some emigration. Changes in mortality rates can introduce error into the predictions, but such error is likely to be relatively small. The future course of immigration is not easy to predict, but migrants tend to be concentrated in the younger adult ages; moreover, net immigration is much smaller than gross immigration. It is extremely unlikely that predictions of the older population would be much in error on account of future migration, at least over the next 25 or 30 years, and probably over a longer period as well. Fertility is predictable with much less certainty; it may well remain at the relatively low levels of recent years, or perhaps a little higher. But then too it could increase substantially once again. Demographic history provides no basis for

strong confidence in any particular fertility assumption, but as far as the older population, as such, is concerned, that is irrelevant. An increase in fertility rates would, of course, increase the population of children and the requirements for educational facilities within a few years, and thereby increase the overall "dependency burden." However, the rise in the rates would have to be very sharp and sustained in order to produce overall dependency ratios as high as those of the 1960s, even half a century from now.

As far as the elderly population of the next few decades is concerned, the demographic die is pretty well cast, then. Aging is (fortunately) a relatively slow process; it occurs at the rate of one year of age per annum. If ever there were an area of public policy where future problems could be seen with some clarity, and well in advance, the "aging population" area would seem to be it.

16. Suggested Research Topics and Areas

The following topics or areas of research are proposed for consideration in connection with the Review, based on the discussion in previous sections. The list is intended to be suggestive, rather than detailed and exhaustive.

1. Basic Demographic Projections

It would seem highly desirable for the Review to have at its disposal rather early in its research program a set of basic demographic projections – population, labour force, educational enrolment, households, and perhaps some others. These would be of use in themselves. They would also be useful to those working on other projects. Our experience in making projections of this kind is that it is desirable to take a long view, at least with regard to the population; projections to say the middle of the next century might be considered, even if only a shorter period were to be dealt with in the Review's final report. The basic projections could be provided to the general body of researchers working on the Review but might also be influenced by results obtained in other projects (e.g., participation rates for use in the labour force projections). Some interaction between the demographic projections project and the others would be desirable over the course of the Review.

2. Model of the Economic-Demographic System

Particular aspects of the relationship between the population and the economy will be investigated but we think it desirable also to have an instrument for assessing the combined economic effects of demographic change. We have in mind a computer-based model that joins a demographic projection model with a model of the economy. We have made extensive use of economic-demographic models of this kind and have found them very useful for exploring the implications of alternative demographic scenarios by computer simulation. Such a model need not be a perfect representation of the real

Canadian economy (no model ever would be!); a "reasonable" approximation may suffice for determining "what matters". For example, what effect would doubling the annual immigration rate have on the cost of public pension plans or aggregate health-care costs in 25 years? What effect would a substantial movement towards earlier retirement have on the gross national product? Precise answers to such questions are not very important, and in any event are not to be believed. But orders of magnitude are important, and estimates of them are attainable by the use of a model of the kind that we have in mind. While studies of particular demographically-related problems and effects are essential, one wants also a "broad picture", and one wants to take account of interrelationships that may not be evident or possible to deal with in particular specialized studies. For example, in studying the future "burden" of pensions and health care it is important to consider as well the effects of population change on the labour force, and hence on the economy's potential level of output and potential tax base for the financing of pensions and health care.

The model that we have in mind would be generally consistent with the schematic representation of the economic-demographic system in Figure 1 (though of course much more detailed). It would incorporate relationships representing production, consumption, capital formation, public expenditure and taxation, and in general all of the basic types of relationship that characterize the macro-economy, and it would link these to a detailed population projection model so that population size and age-sex-distributional effects could be allowed for.

3. *Labour Force Participation*

This area merits separate attention. We have in mind an assessment of current trends in participation rates for various age-sex groups and of what such rates are likely to do in the future. Comparisons with the experience of the United States and other countries would be helpful. The relationship between female participation and levels of fertility should be given special attention. Retirement age patterns should also be given special attention. In general, the project would involve a thoroughgoing study of trends and relationships in labour force behaviour, and the implications of these in light of the ongoing population aging process. The results of this project would influence the assumptions about future participation rates chosen for the labour force projections of project (1) above.

4. *Labour Force Productivity, Mobility, and Age Structure*

We have in mind here a study of the implications of age distribution for the mobility, adaptability, and productivity of the work force, both at the level of the economy as a whole and at the level of particular industries and occupations. The rate at which particular industries can contract their work forces through natural retirement, thus avoiding unemployment and wage losses, is an important consideration, and one that has some bearing on present initiatives in the direction of "freer trade".

The effects of labour force aging on productivity is also an important question, having regard for the fact that young workers may be better educated, and may be the bearers of skills associated with new technology, but that more mature workers are more experienced. In general, the population dynamics of industrial and occupational work forces, and their economic implications, seem to us to be an important topic for investigation.

5. *Public Expenditures*

The implications of population change for government budgets, at all levels of government, is of obvious importance. We have done some work in this area but more work would be desirable. Health care, pension or old age security transfers, and education are the most age-sensitive budget categories, but other categories are affected in varying degree also. Of special interest is the prospective increase in health-care costs as a result of population aging, and how such increase might be offset by the adoption of different health-care technologies or institutional arrangements. We have done work on this issue (with colleagues from the McMaster Department of Clinical Epidemiology and Biostatistics), and we have further work planned.

In assessing the overall effects of population change on government budgets it is important not to get only a one-sided view: one wants to consider the effects of population change on the tax base, as well as on the demand for government-financed services. The integrated economic-demographic model of project (2) above would be useful in this regard, allowing prospective expenditure changes to be assessed in relation to revenue changes.

6. *Immigration and the Economy*

Immigration is so important from the point of view of government policy that it merits a separate study (or set of studies). We would emphasize the importance of assessing the effects of immigration on the economy as a whole, and not just on the labour market, or on the production side of the economy. We would emphasize also the *stock* effects of immigration – the long-term effects on the population and the labour force, as opposed to the short-term flow effects which have often been given greater prominence. (In addition to economic effects, immigration has extremely important social implications which should no doubt be studied also.)

7. *The Elderly of the Future*

Future cohorts of elderly people will be rather different from present ones. For one thing, they will be better educated, on average, and their lifestyles will be different. They will also be different in respect of health status and economic security. A separate study that would seek to identify the differences and assess the likely circumstances of the future elderly population would seem to us desirable. Retirement age, health-care

requirements, the distinction between "young old" and "old old", and so on, would seem appropriate issues for inclusion under this heading.

8. *Review of Pension Studies*

Pension-related issues have been studied extensively in recent years (by the Economic Council of Canada, for example). At the same time, they are obviously of great importance in any evaluation of the effects of population aging, both for the macro-economy and for the income security of the individual. We would suggest that a careful review of previous work be carried out and that a summary report on this work be prepared. The review could also concern itself with identifying needs for further work, including the updating of previous studies, if that seems desirable.

FIGURE 1: Major Economic-Demographic Linkages

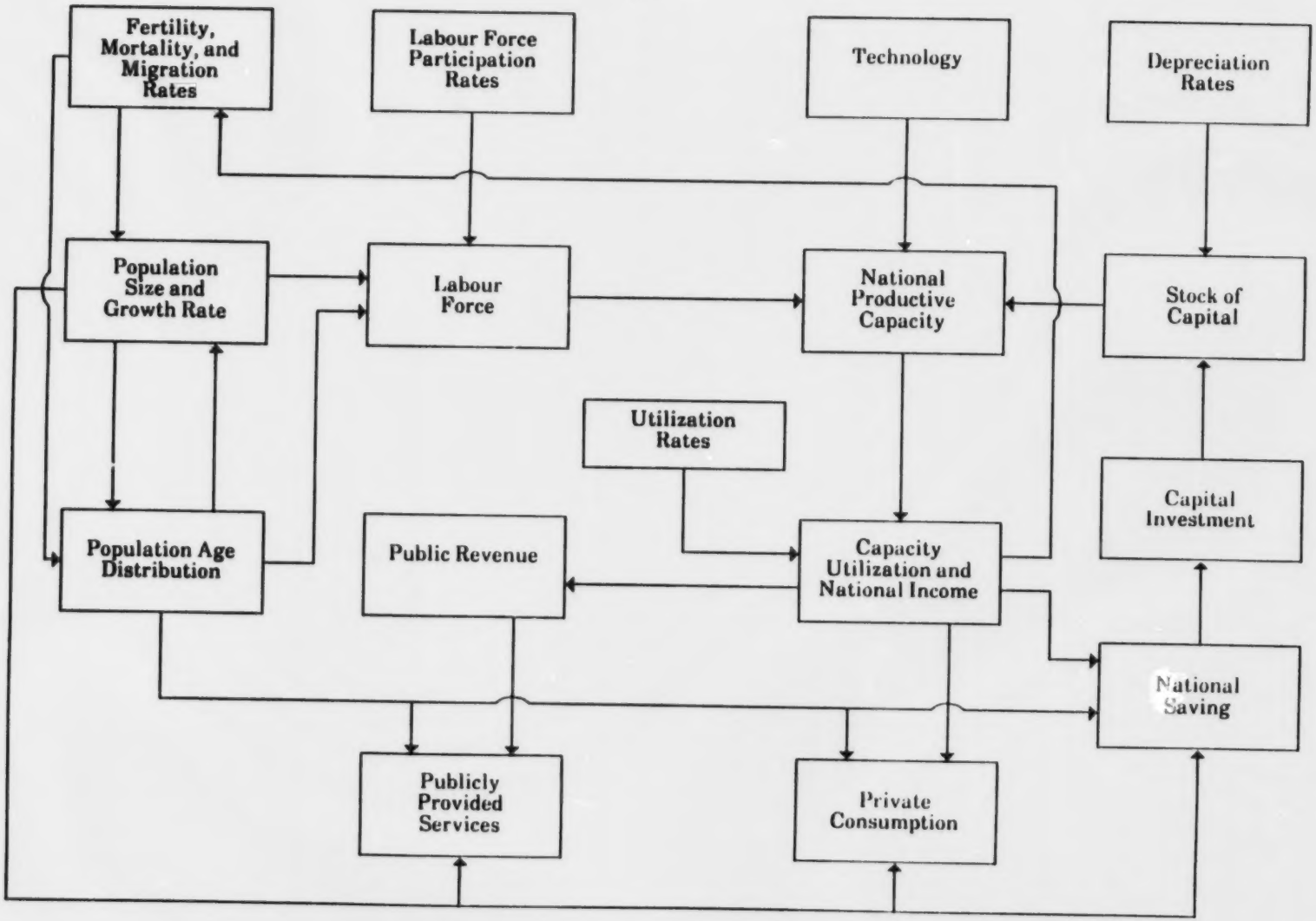

TABLE 1: THE POPULATION OF CANADA: SIZE, GROWTH, AND AGE-DISTRIBUTIONAL CHARACTERISTICS, 1951-1986

Year (June 1)	Total population ('000)	% Increase (previous 5 years)	Age distribution (%)			Dependency ratios		
			Under 20	20-64	65 +	Total pop. / Pop.20-64	Pop under 20 / Pop.20-64	Pop 65 + / Pop.20-64
1951	14009	14.0	37.9	54.4	7.7	1.84	.70	.14
1956	16081	14.8	39.7	52.5	7.8	1.91	.76	.15
1961	18238	13.4	41.8	50.6	7.6	1.98	.83	.15
1966	20015	9.7	42.1	50.2	7.7	1.99	.84	.15
1971	21568	7.8	39.4	52.5	8.1	1.90	.75	.15
1976	22993	6.6	35.8	55.5	8.7	1.81	.65	.16
1981	24342	5.9	32.0	58.3	9.7	1.72	.55	.17
1986*	25591	5.1	28.9	60.5	10.7	1.65	.48	.18

* Preliminary estimates.

TABLE 2: THE CANADIAN LABOUR FORCE AND ITS RELATIONSHIP TO THE POPULATION, 1951-1986

Year	Population ('000; June 1)	Labour force** ('000; annual average)	% Increase (previous 5 years)		Dependency ratio (Pop./LF)
			Population	Labour force	
1951	14009	5351	14.0		2.62
1956	16081	5943	14.8	11.1	2.71
1961	18238	6677	13.4	12.4	2.73
1966	20015	7609	9.7	14.0	2.63
1971	21568	8737	7.8	14.8	2.47
1976	22993	10283	6.6	17.7	2.24
1981	24342	11985	5.9	16.6	2.03
1986*	25591	12898	5.1	7.6	1.98

* Preliminary estimates.
** Includes the armed forces.

TABLE 3: THE PROJECTED POPULATION, 1986-2036: PROJECTION A ("MEDIUM" ASSUMPTIONS)

Year (June 1)	Total population ('000)	% Increase (previous 5 years)	Age distribution (%)			Dependency ratios		
			Under 20	20-64	65 +	Total pop. / Pop.20-64	Pop.under 20 / Pop.20-64	Pop.65 + / Pop.20-64
1986*	25591	5.1	28.9	60.5	10.7	1.65	.48	.18
1991	26783	4.7	27.6	60.6	11.7	1.65	.45	.19
1996	27765	3.7	26.6	60.6	12.8	1.65	.44	.21
2001	28524	2.7	25.5	61.1	13.4	1.64	.42	.22
2006	29131	2.1	24.0	61.8	14.1	1.62	.39	.23
2011	29648	1.8	22.7	61.9	15.4	1.62	.37	.25
2016	30063	1.4	21.8	60.6	17.6	1.65	.36	.29
2021	30318	0.8	21.4	58.7	19.9	1.70	.37	.34
2026	30367	0.2	21.1	56.5	22.3	1.77	.37	.39
2031	30219	-0.5	20.7	54.8	24.4	1.82	.38	.45
2036	29909	-1.0	20.3	54.6	25.1	1.83	.37	.46

* Preliminary estimates.

TABLE 4: PROJECTED POPULATION, 1986-2036: PROJECTION B ("LOW FERTILITY")

Year (June 1)	Total population ('000)	% Increase (previous 5 years)	Age distribution (%)			Dependency ratios		
			Under 20	20-64	65 +	Total pop. / Pop.20-64	Pop.under 20 / Pop.20-64	Pop.65 + / Pop.20-64
1986*	25591	5.1	28.9	60.5	10.7	1.65	.48	.18
1991	26700	4.3	27.3	60.8	11.9	1.64	.45	.19
1996	27449	2.8	25.8	61.3	12.9	1.63	.42	.21
2001	27918	1.7	23.9	62.4	13.8	1.60	.38	.22
2006	28244	1.2	21.6	63.8	14.6	1.57	.34	.23
2011	28466	0.8	19.8	64.2	16.1	1.56	.31	.25
2016	28548	0.3	18.8	62.7	18.5	1.60	.30	.30
2021	28415	-0.5	18.3	60.5	21.2	1.65	.30	.35
2026	28039	-1.3	17.7	58.1	24.1	1.72	.30	.42
2031	27454	-2.1	17.0	56.1	26.9	1.78	.30	.48
2036	26700	-2.7	16.3	55.5	28.1	1.80	.29	.51

* Preliminary estimates.

TABLE 5: PROJECTED POPULATION, 1986-2036: PROJECTION C ("HIGH FERTILITY")

Year (June 1)	Total population ('000)	% Increase (previous 5 years)	Age distribution (%)			Dependency ratios		
			Under 20	20-64	65 +	Total pop. / Pop.20-64	Pop.under 20 / Pop.20-64	Pop.65 + / Pop.20-64
1986*	25591	5.1	28.9	60.5	10.7	1.65	.48	.18
1991	27143	6.1	28.5	59.8	11.6	1.67	.48	.19
1996	29136	7.3	30.1	57.8	12.1	1.73	.52	.21
2001	31150	6.9	31.7	55.9	12.3	1.79	.57	.22
2006	32980	5.9	32.9	54.6	12.5	1.83	.60	.23
2011	34829	5.6	33.1	53.7	13.1	1.86	.62	.24
2016	36939	6.1	32.7	53.0	14.3	1.89	.62	.27
2021	39432	6.7	33.1	51.7	15.2	1.93	.64	.30
2026	42131	6.8	34.2	49.8	16.1	2.01	.69	.32
2031	44822	6.4	35.2	48.4	16.5	2.07	.73	.34
2036	47533	6.0	35.6	48.6	15.9	2.06	.73	.33

* Preliminary estimates.

TABLE 6: PROJECTED POPULATION, 1986-2036: PROJECTION D ("HIGH IMMIGRATION")

Year (June 1)	Total population ('000)	% Increase (previous 5 years)	Age distribution (%)			Dependency ratios		
			Under 20	20-64	65 +	Total pop. / Pop.20-64	Pop.under 20 / Pop.20-64	Pop.65 + / Pop.20-64
1986*	25591	5.1	28.9	60.5	10.7	1.65	.48	.18
1991	27045	5.7	27.6	60.7	11.7	1.65	.46	.19
1996	28312	4.7	26.7	60.6	12.6	1.65	.44	.21
2001	29370	3.7	25.6	61.1	13.3	1.64	.42	.22
2006	30287	3.1	24.2	61.8	13.9	1.62	.39	.23
2011	31120	2.8	23.0	61.9	15.2	1.62	.37	.24
2016	31859	2.4	22.2	60.7	17.1	1.65	.37	.28
2021	32445	1.8	21.9	59.0	19.2	1.70	.37	.33
2026	32830	1.2	21.5	57.0	21.5	1.75	.38	.38
2031	33019	0.6	21.2	55.5	23.4	1.80	.38	.42
2036	33042	0.1	20.8	55.2	24.1	1.81	.38	.44

*Preliminary estimates.

TABLE 7: PROJECTED POPULATION, 1986-2036: PROJECTION E ("LOW MORTALITY")

Year (June 1)	Total population ('000)	% Increase (previous 5 years)	Age distribution (%)			Dependency ratios		
			Under 20	20-64	65+	Total pop. / Pop.20-64	Pop.under 20 / Pop.20-64	Pop.65+ / Pop.20-64
1986*	25591	5.1	28.9	60.5	10.7	1.65	.48	.18
1991	26786	4.7	27.6	60.6	11.7	1.65	.45	.19
1996	27778	3.7	26.6	60.6	12.8	1.65	.44	.21
2001	28552	2.8	25.5	61.0	13.5	1.64	.42	.22
2006	29186	2.2	24.0	61.7	14.2	1.62	.39	.23
2011	29741	1.9	22.6	61.8	15.6	1.62	.37	.25
2016	30208	1.6	21.8	60.4	17.9	1.66	.36	.30
2021	30532	1.1	21.3	58.4	20.2	1.71	.37	.35
2026	30668	0.4	21.0	56.1	22.9	1.78	.37	.41
2031	30632	-0.1	20.5	54.3	25.3	1.84	.38	.46
2036	30462	-0.6	20.0	53.8	26.2	1.86	.37	.49

*Preliminary estimates.

TABLE 8: THE PROJECTED LABOUR FORCE AND ITS RELATIONSHIP TO THE POPULATION, 1986-2036: PROJECTION A ("MEDIUM" ASSUMPTIONS)

Year	Population ('000; June 1)	Labour force** ('000; annual average)	% Increase (previous 5 years)		Dependency ratio (Pop./LF)
			Population	Labour force	
1986*	25591	12898	5.1	7.6	1.98
1991	26783	13767	4.7	6.7	1.95
1996	27766	14494	3.7	5.3	1.92
2001	28524	15090	2.7	4.1	1.89
2006	29131	15364	2.1	1.8	1.90
2011	29648	15418	1.8	.3	1.92
2016	30063	15163	1.4	-1.7	1.98
2021	30318	14770	.8	-2.6	2.05
2026	30367	14408	.2	-2.5	2.11
2031	30219	14083	-.5	-2.3	2.15
2036	29909	13862	-1.0	-1.6	2.16

* Preliminary estimates.
** Includes the armed forces.

TABLE 9: LIFE EXPECTANCIES OF MALES AND FEMALES AT SELECTED AGES, CANADA, 1931 TO 1981

	Life Expectancy		Change in life expectancy		Difference between male and female life expectancy
	Male	Female	Male	Female	
			(Years)		
Age 0					
1931	60.0	62.1	..	..	2.1
1941	63.0	66.3	3.0	4.2	3.3
1951	66.3	70.8	3.4	4.5	4.5
1961	68.4	74.2	2.0	3.3	5.8
1971	69.3	76.4	1.0	2.2	7.0
1981	71.9	79.0	2.5	2.6	7.1
Age 1					
1931	64.7	65.7	..	..	1.0
1941	66.1	68.7	1.5	3.0	2.6
1951	68.3	72.3	2.2	3.6	4.0
1961	69.5	75.0	1.2	2.6	5.5
1971	69.8	76.6	.3	1.6	6.8
1981	71.7	78.7	1.9	2.1	7.0
Age 65					
1931	13.0	13.7	..	..	.7
1941	12.8	14.1	-.2	.4	1.3
1951	13.3	15.0	.5	.9	1.7
1961	13.5	16.1	.2	1.1	2.5
1971	13.7	17.5	.2	1.4	3.8
1981	14.6	18.9	.8	1.4	4.3
Age 80					
1931	5.6	5.9	..	..	.3
1941	5.5	6.0	-.1	.1	.5
1951	5.8	6.4	.3	.4	.5
1961	6.1	6.9	.3	.5	.8
1971	6.4	7.9	.3	1.0	1.5
1981	6.9	8.8	.4	1.0	2.0

Note: Prior to 1951, figures exclude Newfoundland.